

What is claimed is:

1. A fault tolerant optical amplifier apparatus for amplifying transmission signals, said apparatus comprising:
 - 5 a first amplifying fiber segment having a first and second ends, said transmission signals propagating through said first fiber segment;
 - a first directional coupler coupled to said first end of said first amplifying fiber segment;
 - a first optical pump source coupled to said first directional coupler, said pump
- 10 source supplying pump to said first amplifying fiber segment such that a portion of said pump power remains after propagation through said first amplifying fiber segment ;
 - a second amplifying fiber segment having a first and second ends;
 - a second directional coupler coupled to said first end of said second amplifying fiber segment;
- 15 a second optical pump source coupled to said second directional coupler, said pump source supplying pump power to said second amplifying fiber segment;
 - a third directional coupler coupled to said second end of said first amplifying fiber segment;
 - a fourth directional coupler coupled to said second end of said second amplifying
- 20 fiber segment; and
 - a bi-directional optical connection disposed between said third and fourth couplers, such that said portion of pump power remaining after propagation through said first amplifying fiber segment is supplied to said second amplifying fiber segment via said third coupler, said bi-directional connection and said fourth coupler.

2. The apparatus in accordance with claim 1 wherein a portion of said pump power supplied to said second amplifying fiber segment remains after propagation through said second amplifying fiber segment, said portion of said remaining pump power supplied to said first amplifying fiber segment via said third coupler, said bi-directional connection and said fourth coupler.

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3. The apparatus in accordance with claim 1, wherein said first pump source supplies said pump power to said first amplifying fiber segment in a co-propagating direction with respect to the propagation of said transmission signals through said first 10 amplifying fiber segment.

4. The apparatus in accordance with claim 1, wherein said first pump source supplies said pump power to said first amplifying fiber segment in a counter propagating direction with respect to the propagation of said transmission signals through said 15 amplifying fiber segment.

5. The apparatus in accordance with claim 1, wherein said transmission signals is a first set of transmission signals, said amplifying apparatus further comprising a second set of transmission signals propagating through said second amplifying fiber 20 segment, wherein said second pump source supplies said pump power to said second amplifying fiber segment in a co-propagating direction with respect to the propagation of said second set of transmission signals through said second amplifying fiber segment.

6. The apparatus in accordance with claim 1, wherein said transmission 25 signals is a first set of transmission signals, said amplifying apparatus further comprising a

second set of transmission signals propagating through said second amplifying fiber segment, wherein said second pump source supplies said pump power to said second amplifying fiber segment in a counter propagating direction with respect to the propagation of said second set of transmission signals through said second amplifying fiber segment.

7. The apparatus in accordance with claim 2, wherein said portion of said remaining pump power is supplied to said first amplifying fiber in a co-propagating direction with respect to the propagation of said transmission signals through said first amplifying fiber segment.

8. The apparatus in accordance with claim 2, wherein said portion of said remaining pump power is supplied to said first amplifying fiber in a counter propagating direction with respect to the propagation of said transmission signals through said first amplifying fiber segment.

9. The apparatus in accordance with claim 1, wherein said transmission signals is a first set of transmission signals, said amplifying apparatus further comprising a second set of transmission signals propagating through said second amplifying fiber segment, said portion of said remaining pump power supplied to said second amplifying fiber in a co-propagating direction with respect to the propagation of said second set of transmission signals.

10. The apparatus in accordance with claim 1, wherein said transmission signals is a first set of transmission signals, said amplifying apparatus further comprising a

second set of transmission signals propagating through said second amplifying fiber segment, said portion of said remaining pump power supplied to said second amplifying fiber in a counter propagating direction with respect to the propagation of said second set of transmission signals.

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11. The apparatus in accordance with claim 1 further comprising a feed back circuit communicating with said first pump source and said second pump source, said feedback circuit generating a feedback signal to adjust the power output associated with the said first pump source when said second pump source fails.

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12. The apparatus in accordance with claim 1 further comprising a feed back circuit communicating with said first pump source and said second pump source, said feedback circuit generating a feedback signal to adjust the power output associated with the said second pump source when said first pump source fails.

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13. A method for providing pump power to an optical amplifier apparatus for amplifying first and second sets of optical transmission signals, said method comprising the steps of:

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providing a first pump signal to a first amplifying fiber segment;
providing a second pump signal to a second amplifying fiber segment;
directing said first set of transmission signals through said first amplifying fiber segment;
directing said second set of transmission signals through said second amplifying fiber segment;

directing a portion of said first pump signal to said second amplifying fiber

segment after said first pump signal propagates through said first amplifying fiber

segment; and

directing a portion of said second pump signal to said first amplifying fiber

5 segment after said second pump signal propagates through said second amplifying fiber

segment.

14. The method in accordance with claim 13 wherein said first pump signal propagates through said first amplifying fiber segment in a co-propagating direction with
10 respect to said first set of transmission signals.

15. The method in accordance with claim 13 wherein said first pump signal propagates through said first amplifying fiber segment in a counter propagating direction with respect to said first set of transmission signals.

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16. The method in accordance with claim 13 wherein said second signal propagates through said second amplifying fiber segment in a co-propagating direction with respect to said second set of transmission signals.

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17. The method in accordance with claim 13 wherein said second signal propagates through said second amplifying fiber segment in a counter propagating direction with respect to said second set of transmission signals.